(NEW SERIES.) No. 13

SCIENTIFIC MEMOIRS

BY

OFFICERS OF THE MEDICAL AND SANITARY DEPARTMENTS

OF THE

GOVERNMENT OF INDIA.

ORIENTAL OR DELHI SORE.

BY

CAPTAIN S. P. JAMES, M.B., I.M.S.

ISSUED UNDER THE AUTHORITY OF THE GOVERNMENT OF INDIA
BY THE SANITARY COMMISSIONER WITH THE GOVERNMENT
OF INDIA, SIMLA.

CALCUTTA:
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ents for the Sale of Books published by the Superintendent of Governm Printing, India, Calcutta.

IN ENGLAND.

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IN [illegible]

[illegible]

[illegible]

ERNEST LEROUX, 28, Rue Bonaparte, Paris.

MARTINUS NIJHOFF, The Hague, Holland.

IN INDIA.

THACKER, SPINK & CO., Calcutta and Simla.

NEWMAN & CO., Calcutta.

S. K. LAHIRI & CO., Calcutta.

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RAGHUNATH ATMARAM SAGOON, Bombay.

N. C. MATHUR, Superintendent, Nazair Hind Press, Allahabad.

[illegible] M. DIZAL SINGH AND SONS, Mut Press, Lahore.

The Superintendent, American Baptist Mission Press, Rangoon.

ORIENTAL OR DELHI SORE.

THIS [illegible] Oriental or Delhi [illegible] special interest [illegible].

I have [illegible] either as Delhi Sore [illegible] to the place [illegible] eighteen [illegible] the [illegible] from Oriental [illegible] Khan.

The appearance [illegible] and I found that [illegible] were [illegible] was really an Oriental Sore [illegible] nicer [illegible] of an Oriental Sore [illegible] to be more [illegible] another Oriental Sore [illegible] have felt a similar difficulty in diagnosis. I draw attention to it in the hope that a knowledge of the fact that Oriental Sores do not always present very distinctive characters may be of assistance to those who are searching for examples of this disease in parts of India where there is, at present, no record of its occurrence.

I will now give brief notes of the eighteen cases and of the results of my examinations of specimens from them.

Case 1.—Seen at Delhi. *Name*—Moul Chand. *Occupation*—Student. *Age*—21 years.

On the skin of the right cheek, over the angle of the lower maxilla, there is a patch of small papules covering an area of about a square inch. The whole patch is somewhat raised above the general surface of the skin, and the area around it is distinctly indurated. At the summit of each papule there is a crust of papery scales. One of the papules has ulcerated and is exuding a clear fluid. The patient says that the lesion began a year ago as a single small spot which caused no irritation or pain; he thinks he contracted it by cutting himself whilst shaving. He has tried many native remedies, and says that the sore was "burnt away" three times but formed again. The Civil Surgeon considers it to be a true example of a Delhi Sore, basing his diagnosis chiefly upon its long duration, its resistance to all remedial treatment, the appearance of the fluid exuding from the ulcerated surface, and the induration which can be felt for some distance round the lesion.

A small piece, including some of the papules and the edge of the ulcer, was cut from the sore. Films were made by smearing the cut surface of this piece of tissue upon glass slides, and sections were cut from it after it had been fixed in alcohol.

In both the films and sections numerous very characteristic bodies, indistinguishable in appearance from the parasites recently discovered in the spleen and otherwise used in certain cases of tropical splenomegaly, were found. These bodies, which I shall allude to in future as parasites, will be fully described later. Bacilli were not seen in any of the specimens. Films were made from the clear fluid exuding from the ulcerated surface, but in these the characteristic bodies were not found.

The peripheral blood of the patient was examined on several occasions, but no trypanosomes were found. Six months later this case was seen again. The sore had decreased in size and all signs of ulceration had disappeared. A number of papules still remained and there was a good deal of induration round the margin of the lesion.

A small piece, from which films and sections were prepared, was removed from the sore, but on this occasion none of the characteristic parasites could be found. At a second examination a few days later, a similar negative result was obtained. The sore was evidently healing slowly, but had it been seen for the first time at this period it would, in all probability, have been regarded as a fairly typical Delhi Sore, and for that reason the negative result of the subsequent examinations was important.

It was interesting that at this second examination of the case an enlarged gland about the size of a haricot bean was detected in the anterior triangle of the neck below the sore. Enlarged glands had been carefully searched for at the former examination of the case, but none had been found. Unfortunately the

patient refused to have the enlarged gland excised. Throughout the [illegible] months during which the sore had lasted he [illegible] other constitutional symptoms, and at none of the examinations was any enlargement of the spleen nor anything abnormal in the peripheral blood detected.

Case 2.—Seen at Delhi. *Name*—Gopal Singh. *Occupation*—[illegible]. *Age*—32 years.

The patient has an ulcer, about two square inches in size, on the left scapular region. He says it commenced three months ago as a hard lump which afterwards broke down and formed an ulcer. The edges of the ulcer are ragged and thickened, and its base is covered by indolent granulations. There is an inflammatory areola round its margin. In my opinion the ulcer presents few or no characters suggesting a diagnosis of Delhi Sore, but the Assist. Surgeon in charge of the hospital, who has had considerable experience of these sores, assures me that it is one. The Civil Surgeon would not give a definite diagnosis, but inclined to the opinion that it was a Delhi Sore.

Films were made from scrapings obtained on the 14th and 18th of April, and on the latter date sections were cut from a piece of the tissue which had been fixed in alcohol, but in none of the specimens could parasites similar to those met with in Case 1 be found.

Case 3.—Seen at Delhi. *Name*—Ranji Lal. *Occupation*—Shopkeeper. *Age*—33 years.

The patient has come to hospital for the treatment of what he says is a Delhi Sore on the knuckle of his right hand. The Assistant Surgeon and Civil Surgeon both agree that it is a typical Delhi Sore. The lesion, which has lasted 1½ years, is about three-quarters of an inch in width and presents a hard nodular crust which has split open, exposing a shallow raw ulcer. On one finger of the same hand there is the scar of what from the patient's account was a similar sore. The scab of the sore on the knuckle was removed and smears made from its under surface and from the raw surface of the ulcer. Sections were prepared from a piece of tissue cut from the edge of the ulcer.

In all the specimens enormous numbers of large cocci, both free and enclosed in leucocytic cells, were present, but no parasites similar to those found in Case 1 were detected. Apparently the coccus was present in pure culture, and when viewed in thick sections it gave a dotted appearance to the cells in which it was present similar to that given by the parasite found in Case 1; if only sections had been examined it is possible that a mistake might have arisen.

Case 4.—Two slides sent from Quetta. The only particulars received with the slides were that they had been obtained from a Sind Sore which had been present for three months on the hand of a European lady.

In both slides numerous parasites similar to those found in Case 1 were present.

Case 5.—Two slides sent from Quetta. The only particulars received were that the slides were obtained from the raw surface of a Sind Sore occurring on the face of a native boy aged 13.

In both slides numerous parasites similar to those found in Case 1 were present.

Case 6.—Two slides sent from Quetta. They were obtained from a sore on the head of a native woman who had previously suffered from syphilis, and the Civil Surgeon was doubtful as to the correctness of the diagnosis of Sind Sore.

Numerous bacilli were present in the films, but none of the characteristic parasites found in films from the other cases and from Case 1 were seen.

Case 7.—Two slides sent from Shahabad in the Punjab. The only particulars received with the slides were that they were obtained from scrapings of an Oriental Sore occurring on the middle finger of a native man aged 20.

Numerous parasites similar to those found in Case 1 were present in both films.

Case 8.—Two slides sent from Shahabad. The only particulars received were that the slides were obtained from what was presumed to be an Oriental Sore occurring on the shoulder of a man aged 30.

The slides were crowded with bacilli and cocci, but none of the characteristic parasites of Case 1 were present.

Case 9.—Two slides from Shahabad. They were said to have been obtained from an Oriental Sore occurring on the fore-arm of a native girl aged 14.

In both slides numerous parasites similar to those found in Case 1 were present.

Case 10.—Seen at Karnal in the Punjab. *Name*—Ram Singh. *Occupation*—Sepoy. *Age*—28.

The patient came to hospital complaining of having three ulcers on the left foot. The following history was obtained: About a month ago his attention was drawn, by a feeling of itching, to a pimple which had formed on the upper and inner aspect of the base of the second toe. As a result of frequent scratching, the skin over the pimple peeled off, leaving an ulcer surrounded by a red swollen area. About a fortnight later a similar ulcer formed on the base of the great toe opposite the first sore, and about the same time a third sore started on the front of the ankle.

When looked at in a superficial manner the three sores appeared very like ordinary "shoe-bites," but when carefully examined they presented the following distinctive characters.

The oldest sore was covered with a thin white scab from underneath which a little clear fluid could be squeezed out. Over an area of about a square inch round the sore the upper layers of skin had peeled off and the surface was smooth, red, and raised as if by a deposit of new tissue beneath it. Considerable induration could be felt round the area covered by the scab. The sore on the great toe was a small open ulcer surrounded by an inflammatory area. At the centre of the third sore (on the front of the ankle) there was a small open sore from which clear fluid could be squeezed out. Over an area of about a quarter of a square inch round the ulcer the skin surface was raised in small irregular patches as if by deposits of new tissue beneath it, and outside this a red flush area extended for about an inch in every direction.

The facts that two of the sores, though on different toes, were almost touching each other, and that the sore on the great toe had commenced some time after that on the second toe, made it probable that the former had been contracted by accidental inoculation from the latter.

Films made from scrapings obtained from each sore showed the presence of numerous parasites similar to those found in Case I, and one was prepared from a piece of tissue removed from the third sore presented the same appearances as had been observed in smears from the sore of that case.

The patient suffered from a very mild malarial cachexia and an enlarged gland was detected. Nothing abnormal was found in his blood, examined on several occasions.

Case II.—A child about 12 years of age. Examined at the city dispensary in Kasauli. The sore, which is situated on the right cheek, was contracted in Lahore four months ago and was diagnosed as a Lahore Sore by the Assistant Surgeon in charge of the dispensary. It is covered by a thick scab and is about an inch in diameter. There is the characteristic induration round it. The scab was removed and smears made from the granulations scraped from the raw surface of the ulcer. Numerous parasites similar to those found in previous cases were present in the films.

The child's spleen was not enlarged, and nothing abnormal was detected in his peripheral blood.

Cases 12 to 18.—Slides from seven cases of Frontier Sore occurring among the men of the native cavalry regiment at Dera Ismail Khan. The medical officer of the regiment, when sending the slides, informed me that Frontier Sores always occur on the exposed parts of the extremities, and that the patients almost always give a history of their origin from mosquito bites. All the sores from which the films were made had lasted a considerable time before the admission of the men into hospital and they had all been treated more or less vigorously.

The cases may be tabulated as follows :—

Case.	Name and Caste.	Age.	Position of the sore.	Length of time under treatment when the film was taken.	Result of examination of the film.
12	Lachman Singh (Jat).	18 years	On the arm	14 days	A considerable number of parasites present.
13	Karbiga Singh (Jat).	21 "	" foot	70 "	No parasites found.
14	Amrao Ali Khan (Ranger)	19 "	" "	14 "	Parasites present but in small numbers.
15	Hazrat Gool (Pathan)	27 "	" leg	2 "	A large number of parasites present.
16	Ismail Khan (Ranger)	24 "	" ankle	21 "	No parasites found.
17	Lachman (Jat)	18 "	" leg	14 "	Parasites present in small number.
18	Suleman Khan (Pathan)	19 "	" foot	72 "	No parasites found.

I will now describe the appearances presented in films and sections obtained from the tissues of some of the sores referred to above.

Description of films.—Most of the films were made by smearing upon glass slides the granulations freshly scraped from the surface of a sore. They were stained either with Romanowsky's double stain or with Leishman's modification of that stain or with the alcoholic hæmatin stain mentioned below. Under a low power of the microscope they are seen to contain red and white blood corpuscles and an enormous number of large mononuclear cells many of which, even under a ⅔rds inch objective, present a dotted appearance from the presence in their protoplasm of small bodies which look like micrococci. Most of these cells are much larger than the ordinary large mononuclear leucocytes seen in blood films, and in thick parts of the smear they are crowded together and apparently joined to one another in the manner shown in figure 1. Under the same power of the microscope non-nucleated masses of protoplasm containing the micrococcus-like bodies can be seen, and a large number of the same bodies not contained in cells are scattered throughout the film. When the $\frac{1}{12}$th inch objective is turned on, the small dots in the large cells and the micrococcus-like bodies scattered throughout the film at once strike the eye as bodies of very definite appearance and structure. They are usually so numerous and their structure is so characteristic that it is almost impossible to doubt that they are the cause of the lesion from which the film was made. If the bodies lying free among the cells be examined, it will be seen that most are oval in shape, but slightly broader at one end than at the other;

a good many, however, are quite round, and some are pointed at both ends so as to resemble in shape minute torpedoes. The bodies vary considerably in size, but the length of the majority is about half the diameter of a red blood corpuscle. Their circumference is remarkably regular and distinct as though they were provided with a definite capsule. The greater part of their substance stains a faint blue, but near the centre is a large unstained (? vacuolic) area sometimes divided into two by a streak of the blue-stained body-substance. In the interior of each body two masses of chromatin will be seen. One of these is of large size, more or less rounded in shape, and usually situated near the centre—but always touching one edge—of the oval and torpedo-shaped forms, and at the broad end in the forms which are broader at one end than at the other. The second chromatin mass varies in shape from a dot to a comparatively long thick rod. In the latter case it usually lies near the centre and at right angles to the long axis of the parasite (figure 2 *a*, *e*). It stains more deeply than the large chromatin mass. In some parasites I have seen a third mass of chromatin, the presence of which has not been observed in the parasites obtained from cases of splenomegaly.* It is a fine rod-shaped piece usually situated near the more pointed end of the parasite and at right angles to the second rod-shaped chromatin mass (figure 2, *b*). It is thicker at one end than at the other, and tapers in the direction of the second chromatin mass into a fine point. It is present in only a few of the parasites in each film.

In the large cells which occupy so great a portion of the film as many as 70 to 100, or more, parasites are frequently seen, and unless the cell has been somewhat broken up in making the film they appear more rounded in shape and of smaller size than when free. The two chromatin masses can, however, always be made out in each parasite, the smaller one being at some little distance from, and usually at right angles to, the larger one.

In addition to the forms described above there will be seen in films—

(1) Protoplasmic masses containing sometimes a few, sometimes a great many, parasites. These masses are often of remarkable regular shape, and when small and round they look something like red blood corpuscles in which parasites are contained. That they are not so is shown by the fact that in well-stained slides their substance is of the same colour as the bodies of the large mononuclear cells, and they are obviously portions of such cells which have been torn off in making the smear. They are not present in sections. Two

* Since the above was written Lieutenant Christophers has described a rather third mass of chromatin as being present in some of the parasites obtained from cases of enlargement of the spleen in Madras. (Scientific Memoirs by officers of the Medical and Sanitary Departments of the Governments of India, New Series No. 14.)

such non-nucleated masses containing large numbers of parasites are shown in figure 1.

(2) Forms of multiplication. I have observed three forms of the parasite which may perhaps be regarded as stages in a process of multiplication. They are the following:—(*a*) Parasites in which the large chromatin mass has become kidney-shaped, and the small mass considerably elongated; (*b*) Parasites in which the large chromatin mass has divided into two and commencing division of the whole parasite is apparent, (*c*) Forms in which the parasite has apparently divided into three or more (sometimes as many as eight) parts. The last forms are rare but are to be seen in films both free and contained in the characteristic mononuclear cells. They are usually of about the same size and shape as a red blood corpuscle. The body as a whole stains brightly pink and for this reason is easily distinguished from similarly shaped portions of leucocytic cells containing parasites. Its circumference is very distinct, and when the form is contained in a leucocytic cell the line of demarcation between it and the protoplasm of the cell is very plainly seen. Arranged in a remarkably regular manner round the inner periphery of the form are from three to seven or eight chromatin masses which represent the large chromatin masses of an equal number of presumably young parasites. Near the centre of the form the small chromatin masses (which appear only as dots) of the same parasites form a cluster inside the larger ones. One or two unstained vacuolic areas may be present in the form and occasionally a strand of faintly blue-stained substance is seen, but the outlines of the individual parasites are not apparent. One of these forms contained in a large cell is represented in figure 3.

(3) Parasites consisting of little more than a large nucleus surrounded by a small amount of body-substance, the second chromatin mass not being present (figure 1, *f*).

(4) A small number of polynuclear leucocytes, some of which may contain one or two parasites.

(5) *Débris* from the skin tissues, and almost always a few cocci and bacilli.

Thin films made from the blood which exudes after scraping a sore very closely resemble films made from blood obtained by spleen puncture in some cases of tropical splenomegaly. Scattered among the blood corpuscles are a number of the characteristic large cells crowded with parasites, and a considerable number of parasites lying free among the cells and corpuscles are also seen.

Preparation of sections.—[illegible] to were fixed in [illegible] cut from the [illegible] by Christmas.* [illegible] period and [illegible]

[illegible]
[illegible]
Alcohol [illegible]
Absolute [illegible]
Paraffin [illegible]

This stain, if kept for three or four weeks before use, [illegible] and shows up the parasites in the tissues quite as well as [illegible] stain. After taking the [illegible] out of the solution by placing them in warm water they should be floated on to slides and pressed gently with [illegible]. It is found that the sections do not [illegible] in little [illegible] but it is not always necessary. After the sections have been dried and the paraffin melted they are treated in turn with xylol, absolute alcohol, and water. The hematin stain is kept in a wide-mouthed "washing pot" in which the slide carrying the section can be placed. The slides are kept in the stain for from ten to 20 minutes or more until, by an examination under a low power of the microscope, the nuclei of the lymphoid cells are seen to be deeply stained. They are then removed from the pot, washed in water, and dried. A drop of thin Canada balsam is placed on each section and a cover glass pressed gently upon it. The preparation and cutting of sections is usually considered to be a very laborious process requiring a large amount of apparatus, but that this is not the case is shown by the fact that most of my sections were cut during the hot weather in a hotel at Delhi and in the dak bungalow at Karnal.

Unless the thinnest possible sections are used the structure of the parasitic bodies contained in the large cells cannot be made out.

The appearance of a section when viewed under a low power of the microscope is shown in figure 4. The dots in this drawing represent the nuclei of the mononuclear cells of which the extensive new deposit of granulation tissue is composed. This deposit of granulation tissue everywhere pervades the substance of the true skin, almost entirely replacing the normal tissues of the part and causing atrophy, and in places disappearance, of the papillæ, the sweat glands, the hair follicles, and the epidermis. Under a high power the deposit is seen to be almost entirely composed of large endothelioid cells, the majority of which contain in their cytoplasm enormous numbers of

* Scientific Memoirs by officers of the Medical and Sanitary Departments of the Government of India, New Series No. 8.

small, deeply staining bodies, which in thick sections look like large cocci, in thinner sections have a pale zone surrounded by a clear space, and in the thinnest sections present the characteristic structure of the parasitic bodies already described as present in films made from the fresh tissues. Owing to the contraction undergone by the tissues during fixation the bodies appear more rounded and smaller than when seen in films but when very thin parts of the section are examined the two characteristic nuclei of each body are easily seen, and there can be no doubt that the bodies are identical with those seen in films. On the other hand it is easy to understand how Cunningham and Reihl, who had no opportunity of examining films were unable to make out any definite structure in the bodies seen only in sections.

The parasitic bodies are not contained in all the large cells composing the deposit of fresh granulation tissue. Comparatively large areas of tissue may be examined in the cells of which no bodies are present, but in these areas the cells themselves are of the same character as those containing the bodies.

In parts of the section the destruction of hair follicles and sweat glands by the new tissue can be observed, and in figure 5 is shown a portion of a section in which nothing remains but a few cells scattered in the characteristic cells containing parasites.

In addition to the large parasite containing cells there are seen in sections a number of cells resembling lymphocytes and rarely one or two polynuclear cells. In the almost complete absence of polynuclear cells, however, both films and sections from a true case of Delhi Sore differ markedly from specimens obtained from other sores.

Summary of results as regards the presence of parasites in Delhi Sores.—The parasites described were found in the sores of 11 out of the 18 cases of which brief notes have been given above. If the sores themselves are counted, they were found in 13 out of 20 sores. They were not found in the sores of cases 2, 3, 6, 8, 13, 16, and 18. In cases 2, 6, and 8 the correctness of the diagnosis was doubtful. Case 3, which was undoubtedly a true case of Delhi Sore, had lasted eighteen months and on turning to the description of Case 1, which at the time of the second examination had also lasted about the same period, it will be seen that parasites were absent at the time of the second examination, though they were present in abundance six months before. It is quite possible, therefore, that in a certain proportion of sores which are undoubtedly true Oriental Sores, parasites may not be found if the sore has lasted a long time and has commenced to heal. As regards the Frontier Sores it will be noted that cases 13, 16, and 18 in which the parasites were not found had been under treatment in hospital considerably longer than the other cases. It would indeed be surprising if the parasites did not disappear after continuous treatment for 70 days, and I do not doubt that

to the effects of treatment [illegible] three cases and their [illegible] cases [illegible]

Does the parasite [illegible] where it occurs as a cause of Delhi Sore?—[illegible] the parasites of Delhi Sore and these [illegible] spleen, it seemed to me important to [illegible] found as a cause of enlargement of the spleen [illegible] Kurnool where they certainly existed as a cause of Oriental Sore. [illegible] the operation of spleen puncture as many [illegible] possible in the rough hundreds of these [illegible] considerable enlargement of the spleen [illegible] and which, therefore, bore a superficial resemblance in these respects to some cases of *kala azar*.

As it is unnecessary, for our present purpose, to discuss these cases in detail I shall tabulate them as follows:—

Place	Name	Age	Location of sore	Enlargement of spleen	[illegible]	[illegible]
Delhi	Nasir Khan	40	[illegible]	No enlargement detected	[illegible]	[illegible]
Delhi	Zahagir	42	Nearly [illegible]	Little	[illegible]	No malarial parasites [illegible]
Delhi	Abdulla	30	[illegible]	Little	[illegible]	No malaria [illegible]
Delhi	Ghulam	28	To [illegible]	Little	Little	Little
Delhi	Amano	32	Little	Little	Little	Little
Delhi	Lalua	25	Midway between umbilicus and pubes	Two inches below costal margin	For a few days after admission an evening rise of temperature which was stopped by quinine. Has a scar above left leg.	No malaria parasites [illegible]
Sonepat near Delhi.	Ahmed	20	Beyond umbilicus	No enlargement detected.	Has a very [illegible] ulcer on back of both thighs.	No malaria parasites [illegible]
Sonepat	Ranji Lal	30	1½ hands' breadth below costal margin.	Little	Has a very [illegible] ulcer on [illegible]	Little

[illegible]	[illegible]	[illegible]	[illegible]	Condition of liver	Other particulars of the case	Results of examination of slides obtained by spleen puncture and by scraping of ulcers
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Admitted for dysentery no [illegible] duration of spleen enlargement 2 years	No malarial parasites or pigment, no Leishman parasite
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	History of enlarged spleen [illegible] April 1914. Not seen now.	Ditto ditto.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	admitted for dysentery [illegible] now	No malaria parasites or pigment, no Leishman parasites
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	History of occasional fever [illegible] two years	Simple Tertian malaria parasites, no Leishman parasites finger blood also contains S. I. malaria parasites.
[illegible]	[illegible]	[illegible]	[illegible]	Ditto	History of acute fever [illegible] much pain and	Simple Tertian malaria parasites and much pigment; finger blood not examined.
[illegible]	[illegible]	[illegible]	Ditto	No enlargement detected		No malaria parasites or pigment, no Leishman parasites
[illegible]	[illegible]	[illegible]	[illegible]	Ditto	[illegible]	Ditto ditto.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No malaria parasites or pigment, no Leishman parasites, no parasites in scrapings of ulcers.
[illegible]	[illegible]	[illegible]	[illegible]	Ditto	[illegible]	No malaria parasites or pigment, no Leishman parasites.
[illegible]	[illegible]	[illegible]	[illegible]	Ditto	[illegible] spleen enlargement has been considerably diminished under quinine treatment.	Ditto ditto.
21 Sonepat	Gadhi	22	Midway between umbilicus and pubes	One inch below costal margin	In very emaciated and anæmic. Duration of spleen enlargement 12 years.	Ditto ditto.
22 Sonepat	Adam	26	In umbilicus	No enlargement detected.	.....	Ditto ditto.
23 Sonepat	Ram Ram	24	1½ hands below costal margin.	Ditto	History of frequent fever for 6 months.	Scanty malignant Tertian rings and crescents; no Leishman parasites.

Number	Place	Name	Age	[illegible]	[illegible]	[illegible]	[illegible]
24	Panipat	Mi[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	Karnal	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	Karnal	Na[illegible]	27	[illegible]	[illegible]	[illegible]	[illegible]
27	Karnal	Ab[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	Karnal	Satram	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

So far as I could [illegible] the [illegible] type of the [illegible] of most advanced chronic [illegible] cases, including the [illegible] of [illegible] in the Punjab as I visited. It seemed necessary to argue that the [illegible] of [illegible] puncture upon more than the [illegible] resembling those of Delhi Sore [illegible] apparent resemblance to cases known to be [illegible] by [illegible] it was reasonable to conclude that parasites resembling those of Delhi Sore [illegible] as a cause of enlargement of the spleen in the Punjab.

During a subsequent tour in [illegible] I sought [illegible] converse to that just described, *viz.*, [illegible] whether parasites resembling those causing *kala azar* were [illegible] Although I took every opportunity which [illegible] examining specimens from sores of all kinds, I obtained no evidence [illegible] of the occurrence of sores resembling Delhi Sores [illegible] parasites resembling those of *kala azar* as a cause of only local lesions.*

These facts seem to me to be important for, if on the one hand we regard the parasites of Delhi Sore as being identical with those of *kala azar*, they show that while these parasites produce in one part of India only a local infection of mucous [illegible]

* I am aware that when a chronic ulcer of the [illegible] is a case of [illegible] only caused by the so-called Leishman-Donovan parasites, a few parasites may be found in sections made from the tissue in the neighbourhood of the ulcer; but I believe I am in agreement with Dr. Christophers in considering that the ulcers are not *caused* by the parasites. Similar chronic ulcers are as common in cases of true malarial cachexia as in cases caused by the parasites under discussion, and in the latter diseases the presence of one or two parasites in the neighbourhood of the ulcers probably indicates no more than that such ulcers are possibly a path of exit of the parasites from the body.

importance as regards danger to life, in another they produce a very serious and dangerous general disease; and on the other hand, the most probable explanation of the fact that the parasites of Delhi Sore and those of *kala azar*, though indistinguishable in appearance, are in reality quite different in that they produce entirely different pathological effects.

Attempts to communicate the disease to animals.—On the 17th of April the skin of the back of a dog was shaved in two places, and it was inoculated on these areas with scrapings from the granulations of the sore of Case 1 which contained at the time many parasites. The dog was watched for some months but the wounds of inoculation quickly healed and no sore resulted. A similar experiment on another dog was carried out with scrapings from the sores of Case 10, but in this case also no sore resulted.

Although in none of the cases which I saw was there any evidence that Delhi Sores ever result in anything more than a local lesion, in view of the possibility that such sores are the starting point of more serious trouble, I did not think it advisable to try inoculation experiments on human beings. In Case 10, however, the nearness of the two sores on the toes to each other and the fact that one had commenced some time after the other, rendered it very probable that in this case a successful inoculation had been carried out unwittingly by the patient himself while scratching the first sore.

Naga Sores.—During my tour in Assam I had an opportunity of examining films made from scrapings obtained from five sores which had been diagnosed by Civil Surgeons or Assistant Surgeons as Naga Sores. These sores bear no resemblance to Delhi Sores, and the chief characteristic of the films was the presence of a very large number of polymuclear cells some of which contained a few cocci. No parasite of any kind was found in the films.

Spirilla as a possible cause of sores resembling Delhi Sores occurring in dogs.—One of the dogs obtained at Delhi developed upon its upper lip a sore bearing a superficial resemblance to some true examples of Delhi Sore. An examination in the fresh state of the discharge from this sore revealed the presence of numerous spirilla in active movement among the blood corpuscles and other cells. Each spirillum exhibited the same rapid wave-like motion along its own axis as is seen in the *Spirillum obermeyeri*, and when stained and examined under a high power the general resemblance to that organism was very close. Measurements showed, however, that the majority were shorter and perhaps slightly thicker than the spirochætes of relapsing fever. A few are shown in figure 6, which, drawn with the aid of a *camera lucida*, exhibits accurately the general shape of the organisms and their relative size as compared to that of the blood corpuscles.

The peripheral blood of the dog was examined on several occasions, but none of the organisms were detected in it.

In the absence of any experimental work upon this question it is perhaps scarcely justifiable to give even the [illegible] description of it. I do so only with the object of throwing out the suggestion that the so-called Delhi Sores reported to occur commonly among dogs and other domestic animals may possibly be of a different nature and cause, [illegible] from that of the true Delhi Sores occurring in man.

CONCLUSIONS.

1. The deposit of a tumour-like formation of granulation tissue is the essential condition in Delhi Sore. The new tissue infiltrates, destroys, and replaces all the structures of the true skin, and pressing upon the epidermis causes it to atrophy and disappear, so that an ulcer results. Many of the cells composing the new tissue contain parasites which, almost certainly, are the primary cause of the lesion.

2. The parasites cannot be distinguished by examination under the microscope from those obtained from the spleen and other organs in certain cases of splenomegaly and *kala azar*.

3. On the other hand the parasites met with in the Punjab are apparently capable of producing only the comparatively mild local disease known as Delhi Sore, while those in Assam produce only the dangerous general disease known as *kala azar*. This raises some interesting questions, as, for example, whether the parasites of Delhi Sore and of *kala azar*, though obviously belonging to the same class, are different species.

4. A probable mode of infection in Delhi Sore is by the accidental inoculation of material containing the parasites, and it is reasonable to suppose that such inoculation may be effected by a biting insect.

5. The evidence adduced points to the fact that even when numerous parasites are present in a Delhi Sore on the skin for a long period, no general disease, such as *kala azar*, results, and (assuming that the parasites of *kala azar* and Delhi Sore are identical) for this reason as well as for the reason that no case of general infection with the parasite was found in the Punjab where local skin infections with it are not uncommon, it is improbable that the path of infection in *kala azar* is by way of the skin. And if any biting insect were proved to be the infecting agent of Delhi Sores, it would not necessarily follow that this is the mode by which *kala azar* is contracted.

6. The parasites were found in Oriental Sores contracted in Delhi, Karnal, Shahabad, Lahore, Quetta, and Dera Ismail Khan, and for this reason it may be concluded that "Delhi Sores," "Lahore Sores," "Sind Sores," "Frontier Sores," etc., are one and the same disease caused by the same parasite. The ulcers

known as "Naga Sores" in Assam, however, are apparently of a different nature.

7. Attempts to inoculate Delhi Sore to two dogs failed. No experiment was made on human beings, but one of the sores of Case 10 was probably contracted by accidental inoculation from another. The generally accepted opinion that true Delhi Sores occur on dogs and other domestic animals has yet to be confirmed.

8. There has been a tendency of late to regard all cases usually diagnosed in India as "malarial cachexia with enlargement of the spleen" as being due to the parasite recently discovered in the spleen and other organs of some cases diagnosed under this designation in Madras and Calcutta. The evidence in this paper shows that such an opinion is not justifiable in the light of the fact that as regards most cases of great enlargement of the spleen occurring in the Punjab a diagnosis of "malarial cachexia" would, in all probability, in the present state of our knowledge, be correct.